# Data science in healthcare meeting notes



# Agenda

Indico

# Introduction (Carsten Welsch)

Video.
LIV.INNO.
LIV.INNO seminars.

# NW Health Cluster (Katherine Robertson, Phil Carvil)

Katherine Schofield did HEP PhD at Liverpool.
UKRI and STFC.
Facilities at Daresbury, Harwell, Edinburgh, Boulby...
Innovation cluster, UKRI-STFC cluster model - need for academic/industry collaboration.
Clusters include defence, life-sciences...
NW, 7.52M population, 13 universities active in life sciences, 1200 life science and health companies.
STFC deep-tech incubators. Includes Health Business Incubation Centre.

LCR Health PoC Fund to be launched in early 2026. (Proof-of-concept funding, business-led, Liverpool city region funded.)
CERN Venture Connect (incorporate CERN technology into products).

# The University Enterprise Team (Nicolas Nunn)

Liverpool University team "that helps you get impact from your research".
Case study Shelta, VR application to combat social isolation.
Funding:

- Ignition fund, £10k for ECRs.
- Launch fund, £50k.
- Matcelerate, healthcare and materials accelerator £50k...£125k.
- Commercially Curious.
- ICURe.
- Medical device regulatory training.
  See this portal.
  UoL-enterprise@liverpool.ac.uk
  mailto:Nicolas.Nunnn@liverpol.ac.uk

# Collaboration case study - Adaptix (Alexander Hill)

Fermilab, CERN, IBM, Adaptix, VIBO, NATS, MIRION ART RECOGNITION...
Adaptix, digital tomosynthesis.
Several (~3...5) X-ray sources used to reconstruct 3D image. (Less dose than full CT scan.)
STFC late-stage commercialisation grant, £400k.

# HDR UK (Yalda Ashraf Kharaz)

HDR - Health Data Research.
HDR UK.
yalda@liverpool.ac.uk
HDRUKNorth@liverpool.ac.uk
Facilitate access to NHS data. Look at data researchers hub on web site.

# Alder Hey (Olufemi Olajide)

Head of data science at Alder Hey.
See this website.
Some NHS problems:

- £1.2G lost due to missed appointments.
- 30% admin time for doctors.
- 90% bed occupancy.

- 27% staff sickness due to stress.
  Tech fixes have not worked.
- Tech for tech's sake, not problems driven.
- Integration barriers.
- Clinician burnout due to admin overload.
- Data siles block AI insights.
  How can AI be harnessed to tackle problems?
- Pre-emptive care.
- Augmenting expertise.
- Freeing up clinician time
  Issues:
- Ethical implementation.
- Scaling and sustainability.
  Alder Hey has Innovation Hub.
- AI and data lab.
- Rapid prototyping. (E.g. clear mask during Covid epidemic.)
- Simulation/UX lab.
- Immersive lab.
  Case study, missed appointments.
  Costs for patients under 19 are £150M p.a.
  Disproportionately impacts underprivileged children due to transport costs, difficulty taking time off work, childcare for siblings.
  Developed risk prediction model, undertook proactive outreach to highest risk families, offer practical support (e.g. transportation).
  Developed at Alder Hey, trialled at 10 further hospitals.
- £1.25M investment.
- 25% reduction in missed appointments.
- 52...68% improvement on most at-risk patient groups.
- 4000 appointments saved.
- £3M savings.
- 27500 appointments freed up.
  Olufemi.Olajide@alderhey.nhs.uk
  innovation@alderhey.nhs.uk

# Neurorestoration and data science, rewiring hope together (Deepti Bhargava)

The Walton Centre.
Get back lost neurological function.
Tackle overactivity (pain and spasticity), lack of function (motor, breathing, continence, cognition).

Overactivity, can do quite a lot, e.g. kill some brain cells to fix tremors in Parkinson's disease.
Lack of function:

- Use stimulator to trigger breathing.
- Cut sensory nerves from bladder/bowel and add stimulators to control incontinence.
- Implant sensors in brain and stimulate to prevent tremors.
- Boost connections from brain to spine when spinal cord damaged.
- Implant electrodes into brain, pick up signal and use to trigger actions.
- Exoskeleton devices operated by various mechanical/acoustic triggers.
  Obvious problems.
- Invasive, heavy.
- Custom built, not scalable.
- Data-poor (real-time feedback coarse).
- Expensive.
- Not, or poorly, personalised.
- Time consuming.
  Tackle using data science methods. Sensors, real-time analytics, predictive modelling...
  E.g. gripping a cup.
  One problem is that the market is quite small...
  Local projects:
- Stand and transfer system modelling.
- Upper limb movement algorithm and modelling. (Harder than lower limbs/walking!)
- Trunk stability enhancement.
- Minimally invasive continence system.
- Reversible spasticity motor stimulation/sensory feedback system.

# PSA dynamics in prostate cancer (Jane Shortall)

See paper here.
52k people diagnosed, 17k treated with radiotherapy, 30% return for further treatment.
Patient-dependent PSA threshold indication of this.
Look at PSA trajectories.
Data from Christie, Belfast...
Incidental differences in radiotherapy causal? Particularly undertreated seminal vessels?
Used magmaClustR package.
Steer radiotherapy using modelling?

# Parallel sessions

## Trustworthy and explainable AI for clinical decision support

Issues of data security.

## Patient-specific digital twins

Milaan, PhD gas dynamics, beam diagnostics, gas curtain.
Will, PhD on gas jet beam profile monitor.
Ben, street art classification, quark-gluon plasma.
Yves, ML, image processing, healthcare related.
Marinder, gas jet profile monitor.

Idea is that a digital model of a patient is developed so that the effect of treatments can be predicted for a particular patient.
My first thought is that this is impossible! We don't know understand all the necessary biology, and if we did it would still be an enrmously challenging computational problem!
Are there limited areas where this idea could be useful?
Example, wearable devices used to determine motion and steer stimulation (e.g. of arms). See above talk by Deepti.
Use studies done in developing animations for films/games to improve/guide feedback loop?

Another possibility, model hospital environment to increase efficiency of patient throughput, understand spread of infections and where anti-microbial surfaces should be used...

## Physics-informed ML

Identify and deal with biases in data using fundamental understanding of process.

## Synthetic data generation and validation standards

Use MC for looking at management of hospitals.

# CCI Photonics: saving your life in 15 mins (Carlos Meza)

Carlos Alejandro Meza Ramírez
CCI Photonics.
Spin-out from Lancaster University.
Partners:

- University Hospitals of Morecambe Bay.
- Tom Edwards from Liverpool School of Tropical Medicine.
  Tackle problem of AMR - antimicrobial resistance.
  Product InfectiScan$^{TM}$
  Involves taking IR spectrum of sample, but no details given.
  Looking at UTIs (urinary tract infections) at the moment.
  Want the device to be in GP practices in USA and UK and in pharmacies in Mexico.

# Analysis of cardiac MRI (Chloe Bickerstaff)

Mycardium.
Twenty million people die from heart disease p.a. (one in three deaths).
Globally, 64 million people live with heart problems.
Provide AI tools for MRI and echocardiography analysis.
Products:

- EchoConfidence - replace 50 manual measurements made per scan and compare with norms and previous scans.
- 1CMR - analysis of cardiac MRI images. Time of about 10 hours decreased to 2 mins for 14 scans. See this paper
- CoreLab - support pharmaceutical companies in clinical trials. Three years, 30 projects.

# Central nervous system modulation: physiological synchrony for anxiety support (Lucy Jung)

Emphasized that panic attacks are serious!
About 4% of the population has anxiety disorder.
LYEONS neurotech.
Spinout from Imperial?
Develop Neuromodulation devices.
Challenge with medical healthcare, lack of immediate support.
Physiological synchrony is interaction of physiological system of one person with that of another.
Apparently well known in marketing circles!
Track heart rate and other biomarkers. Provide stimulation to restore "balance" (auditory stimulation, vibration?). Explore adaptive exposure approach to remove dependency on stimulation.
(First company, Charco Neurotech, looked at Parkinsons disease. Vibratory stimulus in this case.)
My opinion? There is a serious possibility that this is all placebo effect!

# Close (Carsten Welsch)

Thanks to participants.